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WASTEWATER CLASSIFICATION BY FERTILIZING VALUE (KLASSIFIKATSIYA--ETC(U)
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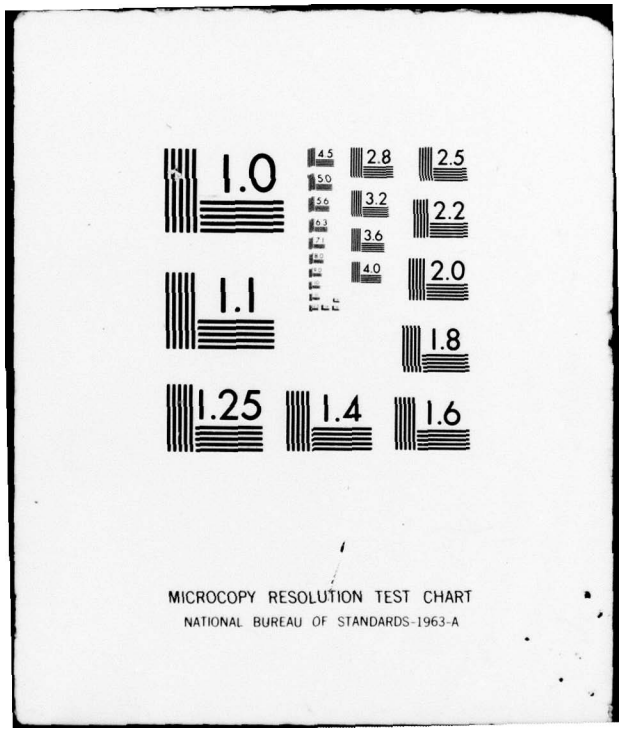
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WASTEWATER CLASSIFICATION BY FERTILIZING VALUE

(Klassifikatsiya Stochnykh Vod Po Udobritel'noy Tsennosti),

V.T. Dodolina

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The fertilizing value of the waste water of cities, settlements, industrial enterprises, and animal husbandry complexes varies. Currently there is no firm classification of waste water by fertilizing value. This creates certain difficulties in the solution of a number of practical problems related to its utilization for irrigation and the development of a system for the further utilizing of irrigated fields. The VNIISSV has done a certain amount of work which has made possible the classification of waste

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water by fertilizing value. This report shows their results.

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WASTE WATER CLASSIFICATION BY FERTILIZING VALUE

KLASSIFIKATSIYA STOCHNYKH VOD PO UDOBRITEL'NOY TSENNOSTI in Russian pp 1-7

[Article by Candidate of Agricultural Sciences V. T. Dodolina, VNIISSV]

The fertilizing value of the waste water of cities, settlements, industrial enterprises, and animal husbandry complexes varies. Currently there is no firm classification of waste water by fertilizing value. This creates certain difficulties in the solution of a number of practical problems related to its utilization for irrigation and the development of a system for the further utilizing of irrigated fields. The VNIISSV has done a certain amount of work which has made possible the classification of waste water by fertilizing value. Three criteria were used as the basis: 1) content of nutritive substances in waste water with various irrigation norms; 2) removal of nutritive substances with the crop; 3) compensating for the loss of nutritive substances through waste water on the basis of norms corresponding to the biological characteristics of the crops.

Table 1 gives the amounts of nutritive substances contained in the various waste water categories (mg/liter) and their amount supplied with different irrigation norms. The table shows that as the watering norm is raised the waste water introduces more nutritive substances into the soil.

The fact that most waste water contains little phosphorus is the general phenomenon. The nitrogen content usually exceeds that of potassium. The richest in nutritive substances are the waste waters released by food and hydrolysis industry enterprises (starch, sugar, and biochemical plants). Such waters sometimes contain 100 to 350 mg/liter nitrogen, up to 150 mg/liter of potassium, and a somewhat lesser amount of phosphorus (70-100 mg/liter). A great deal of nitrogen and potassium is found in the waste water of chemical-pharmaceutical plants, meat combines, and waste water of animal husbandry complexes. The conventionally pure water and the biologically treated industrial, residential and waste waters of industrial enterprises are poor in nutritive substances. The waste water of many textile industry enterprises contains few nutritive substances.

Table 2 shows that, depending on the size of the crop and of biological characteristics, farm crops remove different quantities of nutritive substances (nitrogen, phosphorus, and potassium).

Sunflower, alfalfa, corn, potatoes, sugar beets remove particularly large amounts of biogenic elements, whereas cereal crops (wheat, rye) remove relatively less. Compared with nonirrigated areas, irrigated farm crops remove substantial amounts of nutritive substances.

Table 3 shows the types of waste water which fully compensates the removal of nutritive substances with the crops and the type of waste water which partially compensates for such removal. The question of the fertilizing value is resolved essentially on the basis of the amount of nitrogen and potassium. Nearly almost all types of waste water contain little phosphorus which must be replenished by the application of mineral phosphorus fertilizers (large amounts of phosphorus is found in the waste water of starch and hydrolysis plants and the waste water of animal husbandry complexes). As a nutritive element calcium has equally been ignored. It is present in approximately equal amounts in all types of waste water (60-100 mg/liter) and can fully compensate the amount of calcium removed with all types of farm crops.

The study of Tables 1 and 2 reveals the following: waste water with high fertilizing value is the one containing nitrogen in excess of 100 mg/liter, potassium in excess of 75 mg/liter, and phosphorus 20 mg/liter or more; waste water with average fertilizing value contains 50-70 mg per liter nitrogen, 15-65 mg/liter potassium, and no more than 3 mg/liter phosphorus; low fertilizing waste water contains less than 40 mg/liter nitrogen, no more than 30 mg/liter potassium, and almost no phosphorus.

The data, computations and summations obtained led to the elaboration of the classification of waste water by fertilizing value (Table 4). The table gives the maximum contents of nutritive elements (nitrogen, potassium and phosphorus), and the types of waste water broken down by groups. It provides the classification of agricultural measures by groups based on the fertilizing value of waste water.

Table 1

Content of Nutritive Substances in Waste Water

Таблица I.

Содержание питательных веществ в сточных водах

Сточные воды (1)	(2) Содержание элементов питания (кг) при оросительных нормах																	
	(2) мг/л			1000 м³/га			2000 м³/га			3000 м³/га			4000 м³/га			5000 м³/га			6000 м³/га		
	(3) N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	(4) K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
I	2			3			4			5			6			7			8		
(5) Хозяйственно-бытовые	35	6	12	35	6	12	70	12	24	105	18	36	140	24	48	175	30	60	210	36	72
(6) Текстильных фабрик суконного, тонкосуконного и коврового производств	38	1	13	38	1	13	76	2	26	114	3	39	152	4	52	190	5	65	228	6	78
(7) Текстильных фабрик и комбинатов, отбельно-красильного и хлопчатобумажного производств	34	1	32	34	1	32	68	2	64	102	3	96	136	4	64	170	5	160	204	6	192
(8) Условно-чистые воды химических и других предприятий	22	2	7	22	2	7	44	4	14	66	6	21	88	8	28	110	10	35	132	12	42
(9) Предприятий тяжелой промышленности	27	-	-	12	27	-	-	12	54	-	-	24	81	-	-	36	108	-	-	48	135	-	-	70	162	-	-	72
(10) Химзаводов и химкомбинатов после полной биологической очистки	45	2	14	45	2	14	90	4	28	135	6	42	180	8	56	225	10	70	270	12	84

[Key on p 4]

Cont. Table 1

Продолжение табл.I

I	2	3	4	5	6	7	8
(11) То же после механической очистки	62-2,5-25	62-2,5-25	I24-5-50	I86-7,5-75	248-I0-I00	3I0-I2,5-I25	372-I5-I50
(12) Сахарных заводов (осветление)	50-2-65	50-2-65	I00-4-I30	I50-6-I95	200-8-260	250-I0-325	300-I2-390
(13) Крахмальных заводов при производстве картофельного крахмала	I05-I5-285	I05-I5-286	2I0-30-576	3I5-45-862	220-60-II52	525-75-I430	630-90-I724
(14) Крахмальных заводов при производстве кукурузного крахмала	70-24-83	70-24-83	I40-48-I66	2I0-72-249	280-96-332	350-I20-4I5	420-I44-498
(15) Гидролизных заводов	I50-35-75	I50-35-75	300-70-I50	450-I05-225	600-I40-300	750-I75-375	900-2I0-450
(16) Мясокомбинатов	285-38-95	285-38-95	570-70-I90	855-I05-285	II40-I40-380	I425-I75-475	I7I0-2I0-570
(17) Животноводческих комплексов	300-I00-I94	300-I00-I94	600-200-388	900-300-582	I200-400-776	I500-500-870	I800-600-II64

[Key to Table 1]

1. Waste water
2. Content of nutritive elements (kg) with irrigation norms
3. mg/liter
4. cubic meters per hectare
5. Industrial-residential
6. Wool, fine-wool and carpet manufacturing textile factories
7. Bleaching-dyeing and cotton manufacturing textile factories
8. Conventionally clean water of chemical and other enterprises
9. Heavy industry enterprises
10. Chemical plants and chemical combines after full biological treatment
11. Same after mechanical treatment
12. Sugar plants (clarified)
13. Starch plants producing potato starch
14. Starch plants producing corn starc
15. Hydrolysis plants
16. Meat combines
17. Animal husbandry complexes

Table 2

Removal of Nutritive Substances with Farm Crops

Nutritive Elements, kg

Таблица 2

Вынос питательных веществ с урожаем сельскохозяйственных культур

элементов питания, кг

Культура (1)	Урожай без орошения, ц/га (2)	Без орошения (3)			Урожай при орошении, ц/га (4)	При орошении (5)		
		N	P_2O_5	K_2O		N	P_2O_5	K_2O
(6) Озимая пшеница	25/60	100	35	75	50/100	200	70	150
(7) Озимая рожь	25/60	75	30	65	50/90	120	50	120
(8) Яровая пшеница	25/60	95	30	45	50/100	180	65	90
(9) Кукуруза на (силос)	50/400	130	50	120	700	250	90	220
(10) Подсолнечник на (силос)	300	120	45	225	550	220	90	400
(11) Картофель	120	70	35	120	220	130	70	200
(12) Сахарная свекла	250	150	45	150	450	250	80	250
(13) Кормовая свекла	400	120	35	250	700	200	60	500
(14) Конопля	70	115	35	65	140	230	70	130
(15) Сенокосы (травосмесь сено)	30	70	30	85	60	150	60	180
(16) Пастбища (зеленая масса)	350	120	45	150	700	220	75	300
(17) Клевер (сено)	40	85	30	110	80	170	60	220
(18) Люцерна (сено)	50	130	35	85	100	260	70	170
(19) Злаковые травы	40	70	30	80	80	130	50	160

Примечание. Данные о выносе питательных веществ взяты из учебников "Агрохимия" (М., изд. "Колос", 1967) и "Луговодство" (М., изд. "Колос", 1966).

Key:

1. Crop
2. Yield without irrigation, quintals/hectare
3. Without irrigation
4. Yield with irrigation, quintals/hectare
5. With irrigation
6. Winter wheat
7. Winter rye
8. Spring wheat
9. Corn (silage)
10. Sunflower (silage)
11. Potatoes
12. Sugar beets
13. Fodder beets
14. Hemp
15. Hay fields (mixed grass hay)
16. Pastures (green mass)
17. Clover (hay)
18. Alfalfa (hay)
19. Cereal grasses

Note: Data on the removal of nutritive substances taken from the textbooks "Agrokhimiya" [Agrochemistry] (Kolos Publishing House, Moscow, 1967) and "Lugovodstvo" [Meadow Cultivation] (Kolos Publishing House, Moscow, 1966).

Table 3

Compensation for Removal of Nutritive Substances with Farm Crops Through Waste Water Irrigation

Crop	Irrigation norm, m^3/hectare	Waste water fully compensating removal of nutritive substances (high fertilizing value)	Waste water compensating removal of nutritive substances 50% or somewhat less (medium fertilizing value)	Waste water compensating removal of nutritive substances less than 30% (low fertilizing value)
Grain	1500-2000	Starch, hydrolysis plants, meat combines, animal husbandry complexes	Sugar plants, chemical combines	Industrial-residential conventional clean water, waste water of texile and heavy industry enterprises
Corn (for silage)	4000	Sugar, starch and hydrolysis plants, meat combines, waste water of animal husbandry complexes	Chemical combines, chemical plants (after mechanical treatment)	Same
Sunflower (for silage)	4000	Same	Sugar plants, chemical combines	Same
Sugar beets	4000	Starch, hydrolysis plants, meat combines, chemical plants, animal husbandry complexes	Sugar plants, chemical combines, chemical plants (after mechanical treatment)	Same
Fodder beets	5000	Starch, hydrolysis plants, meat combines, animal husbandry complexes	Sugar refineries, chemical combines (after mechanical treatment)	Same
Potatoes	3000	Sugar, starch, hydrolysis plants, meat combines, animal husbandry complexes	Chemical combines, chemical plants (after mechanical treatment)	Same
Pastures	6000	Sugar, starch, hydrolysis plants, chemical combines, meat combines, animal husbandry complexes	Same	Same
Perennial grasses	6000	Same	Same	Same

Table 4

Classification of Waste Water by Fertilizing Value

Group	Content of nutritive elements mg/liter	Compensation for removal of nutritive substances through waste water irrigation	Waste water	Recommended use of fertilizers
I - high fertilizing value waste water	Nitrogen--100 or more Potassium- 75 or more Phosphorus-20 or more Calcium, over 100	100% or more	Starch, hydrolysis, some chemical plants, meat combines, animal husbandry complexes, enterprises with high nitrogen, phosphorus, potassium content	Application of nitrogen and potassium fertilizers not required; phosphorus fertilizers applied
II - waste water of medium fertilizing value	Nitrogen--50-70 Potassium-15-75 Phosphorus-3-15 Calcium-0 50-70	Under 100%	Sugar, chemical plants and combines, industrial and residential waste water of small settlements	Application of 50% of the full amount of chemical fertilizers required
III - waste water of low fertilizing value	Nitrogen--40 or less Potassium-30 or less Phosphorus-1-5 or less Calcium-50-70	Under 50%	Industrial-residential and conventional treated water of industrial enterprises; textile and heavy industry	Application of full norm required of nitrogen, potassium, and phosphorus fertilizers, particularly in underproductive soils